National Nuclear Security Administration
Office of Global Threat Reduction

Strategic Plan

Reducing Nuclear and Radiological Threats Worldwide

January 2007

National Nuclear Security Administration

"The greatest threat before humanity today is the secret and sudden attack with chemical …radiological or nuclear weapons…"

President George W. Bush
February 2004

"GTRI has worked with our allies to significantly accelerate and expand international efforts to reduce and protect vulnerable nuclear and radiological materials."

William H. Tobey,
Deputy Administrator,
Defense Nuclear
Nonproliferation
January 2007

January 2007

The greatest threat to our national security is the possibility of terrorists acquiring the materials needed to construct and use a nuclear or radiological weapon of mass destruction. The detonation of a crude nuclear weapon or radiological dirty bomb would result in significant loss of life, economic hardship and psychological effects that would forever change the world.

Nuclear and radiological materials are located at thousands of civilian sites in over 95 countries worldwide. These materials are used for legitimate and beneficial commercial, medical, and research purposes. Unfortunately, materials at many civilian sites are poorly guarded or are no longer needed, making them attractive targets for theft or sabotage. The bipartisan 9/11 Commission report shows that al-Qaeda has tried to acquire or make weapons of mass destruction for at least 10 years. The 9/11 Commission believes there is no doubt that the United States would be a prime target.

In his 2006 *National Security Strategy of the United States of America,* President Bush identified preventing the transfer of fissile material to rogue states or terrorists as a top priority to protect the American public. In July 2006, Presidents Bush and Putin announced a *Global Initiative to Combat Nuclear Terrorism*, aimed at strengthening international cooperation to secure nuclear and radiological materials and to prevent the use of these materials in terrorist acts.

The Global Threat Reduction Initiative (GTRI) within the Department of Energy's National Nuclear Security Administration (NNSA) is a vital part of the President's National Security Strategy and the Global Initiative. GTRI's unique mission to reduce and protect vulnerable nuclear and radiological material located at civilian sites worldwide directly addresses recommendations of the 9/11 Commission. Each kilogram or curie of this dangerous material that is removed reduces the risk that a terrorist bomb will go off.

This strategic plan presents GTRI's mission, goals, and priorities in meaningful and measurable terms, and explains the critical role that GTRI plays in achieving national and global security objectives.

William H. Tobey
Deputy Administrator
Defense Nuclear Nonproliferation
National Nuclear Security Administration

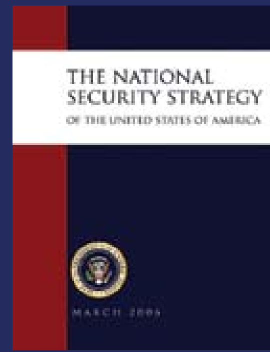
EVOLVING THREAT

In previous decades, nuclear nonproliferation focused on preventing non-nuclear-weapons states from acquiring nuclear weapons. International safeguards and export controls under the *Treaty on the Nonproliferation of Nuclear Weapons (NPT)* were the main tools used to prevent the spread of nuclear weapons.

In recent years, the threat of a large-scale sophisticated terrorist attack has dramatically increased. The U.S. Department of State's *Country Reports on Global Terrorism 2005* notes that in addition to al-Qaeda's organized terrorist operations, other loose networks of terrorist groups have emerged and are conducting an increasing number of attacks on civilian targets. This demonstrates that al-Qaeda and other terrorist groups have and will continue to attempt attacks with the purpose of inflicting heavy loss of life, frightening and disrupting civilian populations, and damaging global infrastructure.

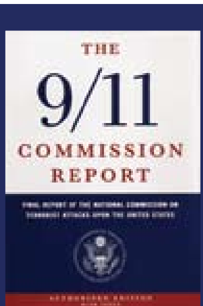
In the post-9/11 world, nonproliferation and threat reduction efforts are expanding and accelerating to prevent nuclear and radiological materials from falling into the hands of terrorist groups. Of particular concern are the thousands of civilian sites where nuclear and radiological materials are used for legitimate and beneficial commercial, medical, and research purposes. Civilian sites generally have less protection than military stockpiles of nuclear materials and include sufficient quantities for crude nuclear weapons and radiological dirty bombs.

GTRI works with international partners to reduce and protect vulnerable nuclear and radiological material located at civilian sites worldwide. GTRI is a vital part of the U.S. strategy to address the evolving terrorist threats by preventing their acquisition of nuclear and radiological materials. Each kilogram or curie of this dangerous material that is removed reduces the risk that a terrorist bomb will go off.



"To keep fissile material out of the hands of rogue states and terrorists…we must address the danger posed by inadequately safeguarded nuclear and radiological materials worldwide. The Administration is leading a global effort to reduce and secure such materials as quickly as possible through several initiatives including the Global Threat Reduction Initiative (GTRI)."

The National Security Strategy of the United States of America
March 2006



"The greatest danger of another catastrophic attack in the United States will materialize if the world's most dangerous terrorists acquire the world's most dangerous weapons… al-Qaeda has tried to make nuclear weapons for the last 10 years."

The National Commission on Terrorist Attacks Upon the United States
July 2004

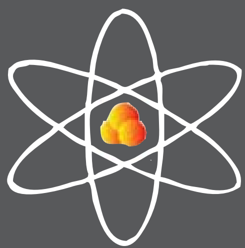
DID YOU KNOW?

"According to the experts surveyed, the possibility of a WMD attack against a city…is real and increasing over time…the probability of a radiological attack…was twice as high as…for a nuclear or biological attack…"

The Lugar Survey on Proliferation
Threats and Responses
Senator Richard G. Lugar
June 2005

MATERIALS OF CONCERN

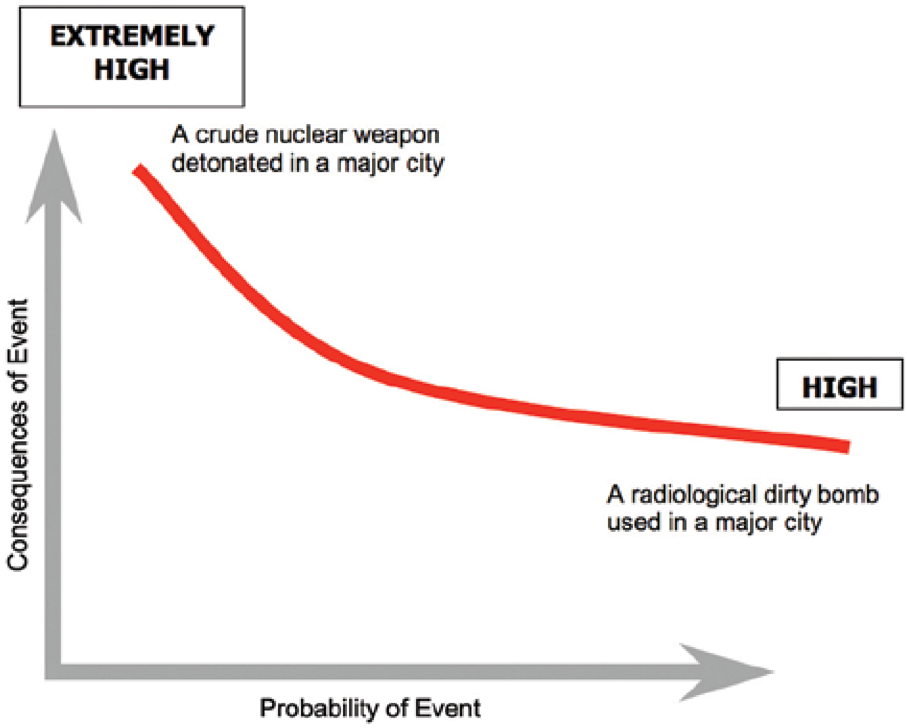
DID YOU KNOW?



According to the International Atomic Energy Agency (IAEA), 25 kg of HEU (about the size of a grapefruit) or 8 kg of plutonium (about the size of a soda can) represent a "significant quantity" required to make a crude nuclear weapon.

NUCLEAR MATERIALS

Experts agree that the most difficult step for terrorists seeking to make a crude nuclear weapon is the acquisition of fissile materials, highly enriched uranium (HEU) and plutonium. According to published reports, no terrorist organization is believed to have the capacity to produce nuclear weapons-usable materials, but HEU is currently used as fuel for many civilian research reactor operations. In addition, significant quantities of weapons-usable HEU and plutonium are used in legitimate commercial, medical, and scientific endeavors such as medical isotope production and scientific research. Many of these civilian nuclear facilities are lightly guarded and the risk of theft of these materials is significant. Currently, there remain more than 160 civilian locations worldwide with HEU and plutonium.



Notional comparison of impacts from potential terrorist acts involving radiological and nuclear WMD

RADIOLOGICAL MATERIALS

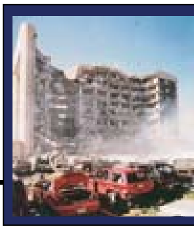
Millions of radioactive sealed sources are used around the world for legitimate and beneficial commercial applications such as cancer treatment, food and blood sterilization, oil exploration, remote electricity generation, radiography, and scientific research. These applications use isotopes such as Cesium-137, Cobalt-60, Strontium-90, Americium-241, Iridium-192, Plutonium-238, Plutonium-239, Curium-244, Radium-226, and Californium-252. Any of these materials could be used to make a radiological dirty bomb. Many of these radiological sources at sites around the world are no longer needed and have been abandoned or orphaned; others are poorly guarded, making the risk of theft or sabotage significant. Currently, there are tens of thousands of civilian locations worldwide with radioactive material, about 5,000 of which contain sources of 1,000 curies or greater.

DID YOU KNOW?

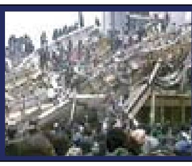
As little as 1,000 curies of radioactivity (about the size of a roll of quarters) represents a "significant quantity" required to make a large radiological dirty bomb.

1990s

JAPAN ~ *March 1995*
Aum Shinrikyo cult group launches WMD attack with sarin on Tokyo subway killing 12 people and injuring over 1,000. Attackers carried the sarin in plastic bags and newspapers and dispersed the chemical at five separate locations by puncturing the bags with umbrella tips. Law enforcement later learned Aum Shinrikyo acquired data about nuclear facilities in Russia, South Korea, China, and Taiwan.



OKLAHOMA CITY ~ *April 1995*
Domestic terrorists detonate a truck bomb at the Alfred P. Murrah Federal Building killing 168 people.



KENYA and TANZANIA ~ *August 1998*
Al-Qaeda launches simultaneous suicide car bombings on U.S. embassies in both countries killing 257 people and wounding over 4,000.

2000

YEMEN ~ *October 2000*
Suicide bombers attack U.S. guided missile destroyer *USS Cole* killing 17 sailors at the Yemeni port of Aden.

2001

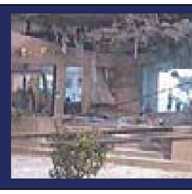
NEW YORK, WASHINGTON, DC, and PENNSYLVANIA ~ *September 11, 2001*
Al-Qaeda terrorists hijack and crash four airliners killing nearly 3,000 and destroying the World Trade Center and damaging the Pentagon.

2002

INDONESIA ~ *October 2002*
Al-Qaeda affiliated group, Jemaah Islamiah, launches coordinated bombing attacks in Bali killing 202 and injuring 209. One bomb in a backpack was likely a suicide bomb. A second explosion that occurred 15 seconds later was a 1,000 kg car bomb that was remotely detonated.

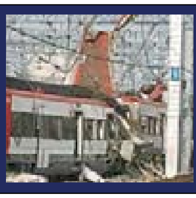
2003

SAUDI ARABIA ~ *May 2003*
Terrorists believed to be affiliated with al-Qaeda use suicide truck bombs to attack three Western residential compounds, killing 21.



MOROCCO ~ *May 2003*
Al-Qaeda linked Salafia Jihadia conducts five coordinated bombings aimed at Western and Jewish targets killing 33 people and injuring more than 100.

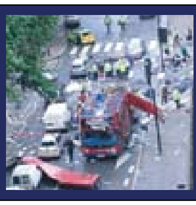
2004



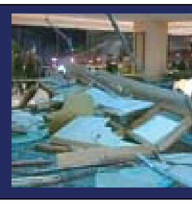
SPAIN ~ *March 2004*
Islamic terrorists detonate 10 backpack bombs using cell phones on commuter trains in Madrid killing 191 people and injuring more than 1,500.

RUSSIA ~ *September 2004*
Chechen militants consisting of 32 attackers armed with substantial explosives seize Beslan School Number One taking more than 1,200 school children and adults hostage. A shootout between Russian security forces and Chechen militants results in 344 civilians dead, 186 of them children, and hundreds wounded.

2005

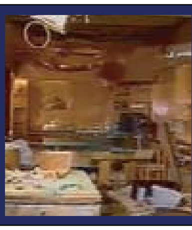


UNITED KINGDOM ~ *July 2005*
Islamic terrorists detonate three suicide bombs in the London Underground and a fourth on a double-decker bus, killing 56 and injuring about 700.

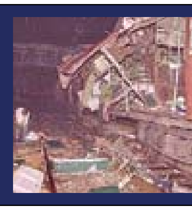


JORDAN ~ *November 2005*
Al-Qaeda launches attacks with suicide bombers at three hotels in Amman frequented by Western military contractors and diplomats killing 59 and injuring more than 150.

2006



EGYPT ~ *April 2006*
Terrorists explode three bombs in the Red Sea resort town of Dahab, killing 18 and wounding 85, the third terrorist attack on a Sinai resort, popular with Western tourists, in two years. Conflicting reports indicate bombing may have been either suicide bombs, remote detonation, or timing devices.



INDIA ~ *July 2006*
Islamic militant group conducts coordinated attack involving seven explosions in India's financial capital killing at least 714. Remote controlled explosive devices are believed to have been used.

ADDRESSING THE THREAT

Office of Global Threat Reduction

Global Threat Reduction Initiative (GTRI)
Established: May 2004

THREAT ENVIRONMENT

A terrorist detonation of a crude nuclear weapon or radiological dirty bomb would have catastrophic consequences, with extensive infrastructure damage and radioactive contamination that would prohibit use of the area; huge economic losses in the hundreds of billions of dollars; and significant casualties. Longer-term effects could include the likelihood of a global recession or depression.

Three main threat scenarios are listed below in decreasing order of likelihood, but increasing order of consequences.

- Terrorists could acquire radioactive materials and construct radiological dirty bombs.
- Terrorists could acquire highly enriched uranium or plutonium and build a crude nuclear weapon with up to a few kilotons of explosive power.
- Terrorists could acquire a nuclear weapon with explosive power of tens to a few hundred kilotons.

As recently as September 2006, an al-Qaeda leader in Iraq, Abu Hamza al-Muhajer, called for nuclear scientists and explosive experts to join the "holy war against the West…..*We are in dire need of you...the field of jihad can satisfy your scientific ambitions, and the large American bases are good places to test your unconventional weapons, whether biological or dirty, as they call them*."

OVERALL STRATEGY TO PROTECT THE UNITED STATES

The U.S. strategy to protect against nuclear and radiological threats has five key components:

1. **Prevent the acquisition of nuclear weapons, special nuclear materials, and radiological materials;**
2. **Deter the threat, if possible;**
3. **If prevention and deterrence fail, then detect, interdict, and render safe the nuclear or radiological device;**
4. **Identify the nature and source of the nuclear or radiological device; and**
5. **Prepare for and respond to possible use.**

THREAT RESPONSE

In response to this threat environment, the Department of Energy's National Nuclear Security Administration established the **GTRI** on May 26, 2004. GTRI's main mission is to address the dangers posed by nuclear and radiological materials located at civilian sites worldwide.

GTRI complements traditional nonproliferation programs, such as international safeguards and export controls, by providing permanent threat reduction through the removal and elimination of excess nuclear and radiological materials in civilian applications.

GTRI is a vital part of the President's March 2006 *National Security Strategy of the United States of America*, an important element of the President's July 2006 *Global Initiative to Combat Nuclear Terrorism*, and directly addresses the recommendations of the bipartisan 9/11 Commission.

DID YOU KNOW?

GTRI was officially announced at IAEA Headquarters in Vienna, Austria, on May 26, 2004 at a joint event between the United States, the Russian Federation, and the IAEA. GTRI consolidated several fragmented and separately managed threat reduction programs into a single program to focus and accelerate NNSA's threat reduction efforts.

DOE STRATEGIC THEME 2, NUCLEAR SECURITY; GOAL 2.2: WEAPONS OF MASS DESTRUCTION

Prevent the acquisition of nuclear and radiological materials for use in weapons of mass destruction and in other acts of terrorism.

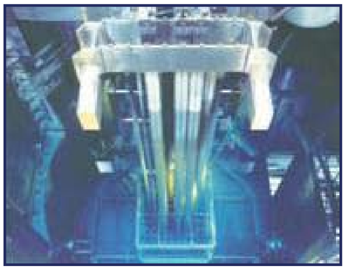
Department of Energy Strategic Plan
October 2006

GTRI MISSION:

Reduce and protect vulnerable nuclear and radiological material located at civilian sites worldwide

GTRI has three goals — **CONVERT, REMOVE, AND PROTECT** — which provide a comprehensive approach to achieving its mission and denying terrorists access to nuclear and radiological materials.

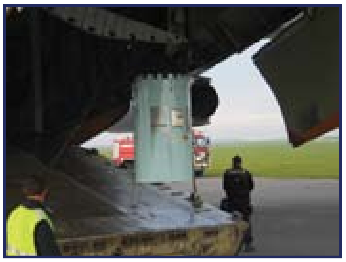
CONVERT reactors from the use of WMD-usable highly enriched uranium (HEU) to low enriched uranium (LEU)



These efforts result in permanent threat reduction because the minimization, and to the extent possible, the elimination of HEU in civilian applications means one less source of bomb material.

VR-1 Sparrow Research Reactor at the Czech Technical University, Prague

REMOVE or dispose of excess WMD-usable nuclear and radiological materials



These efforts result in permanent threat reduction because each kilogram or curie of this dangerous material that is removed reduces the risk that a terrorist bomb will go off.

HEU removed from the Czech Republic

PROTECT at-risk WMD-usable nuclear and radiological materials from theft and sabotage

These efforts result in threat reduction by rapidly upgrading the physical security at vulnerable sites until a permanent threat reduction solution can be implemented.

Protective measures for HEU storage in the former Soviet Union

CONVERT PROGRAM

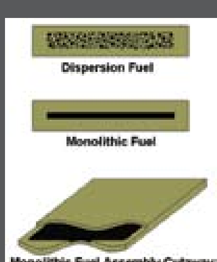
Reduced Enrichment for Research and Test Reactors (RERTR)
Established: 1978

CAN LEU FUEL REPLACE HEU?

YES. ***"…experts in general agree on the feasibility of substituting HEU with LEU in the civilian sector in almost all cases."***

Chairman's Summary; HEU Minimization Conference; Oslo, Norway June 2006

The GTRI Convert Program has developed high-density advanced or improved LEU fuels that will enable both reactor and isotope producers to use an LEU fuel or target in a safe and secure manner.



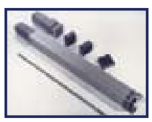
Fuel fabrication technologies focus on increasing fuel density to make up for reduced enrichment.

OBJECTIVE

GTRI's Convert Program supports permanent threat reduction by minimizing and, to the extent possible, eliminating use of HEU in civilian applications throughout the world. The Convert Program is key to the mission because it removes the need for HEU at civilian sites. Once the need is eliminated, any remaining HEU fresh and spent fuel can be taken by GTRI's Remove Program for permanent disposition.

SCOPE OF WORK

By 2018, convert to LEU 129 of 207 HEU research reactors. The IAEA identified 207 research reactors designed to operate on HEU fuels. These reactors average five kg of HEU per reactor to operate. LEU fuel exists or is being developed that will allow 129 of these 207 reactors to be converted, thus minimizing the use of HEU in civilian applications. The remaining 78 research reactors have a defense-related mission or they are of a unique design and are not convertable.



U.S.-Designed Research Reactors

TRIGA Fuel Assembly

TRIGA (Training, Research, Isotopes, General Atomics)

- **HEU:** 6-10 kg of pin type uranium – zirconium hydride (UZrHx) in core
- **LEU:** Fuel Life Improvement Program fuel, also a UZrHx with higher uranium density

MTR (Materials Test Reactor)

- **HEU**: 2-6 kg of plate type dispersion fuel in core
- **LEU:** most conversions with uranium silicide dispersion fuel (few conversions with uranium aluminum or oxide LEU fuels with higher uranium density)

High-Performance

- **HEU**: up to 20 kg of plate type dispersion uranium aluminum metal (UAlx-Al) fuel in core (uses 2-120 kg HEU per year)
- **LEU**: requires high-density fuel under development

Other Research Reactors

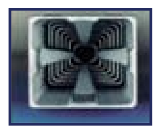
SLOWPOKE Facility Schematic

Canadian SLOWPOKE (Safe Low-Power Kritical Experiment)

- **HEU**: 1 kg of pin type uranium aluminum metal fuel in a core cage
- **LEU**: oxide fuel

Chinese MNSR (Miniature Neutron Source Reactor)

- **HEU**: 1 kg of pin type uranium aluminum metal fuel in a core cage
- **LEU**: oxide fuel expected to be feasible (studies underway)



Russian-Designed Research Reactors

IRT Fuel Assembly

IRT (In-Reactor Thimble (Fast Test Reactor))

- **HEU**: 5 kg of squared tube uranium aluminide or oxide dispersion fuel in core
- **LEU:** uranium oxide with higher density, similar geometry

WWR-M

- **HEU**: 5 kg of exterior hexagonal tube with a circular interior tube uranium aluminide or oxide dispersion fuel in core
- **LEU:** uranium oxide with higher density, similar geometry

WWR-TS

- **HEU**: 5 kg of tubular hexagonal uranium aluminide or oxide dispersion fuel
- **LEU:** uranium oxide or uranium silicide with higher density, similar geometry requires assembly qualification

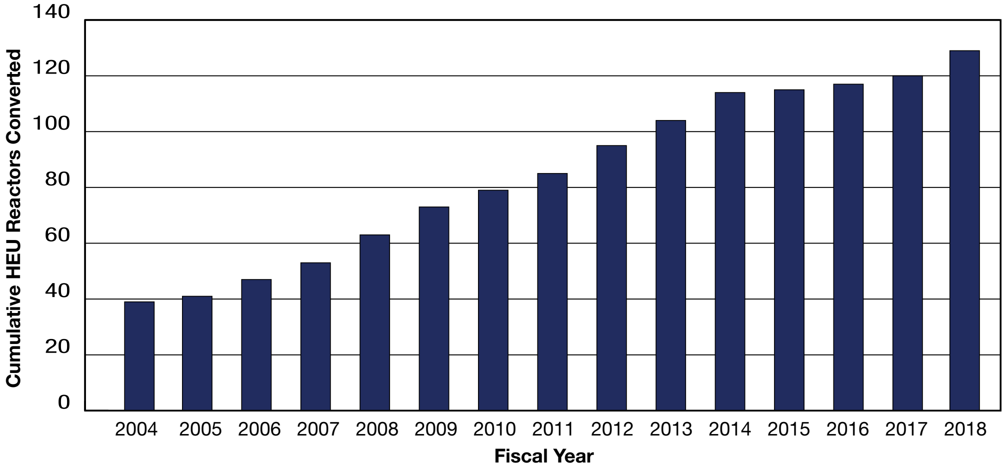
MR (Material Reactor)

- **HEU**: 5 kg of circular tube uranium aluminide or oxide dispersion fuel
- **LEU:** uranium oxide or uranium silicide with higher density, similar geometry requires silicide fuel assemblies

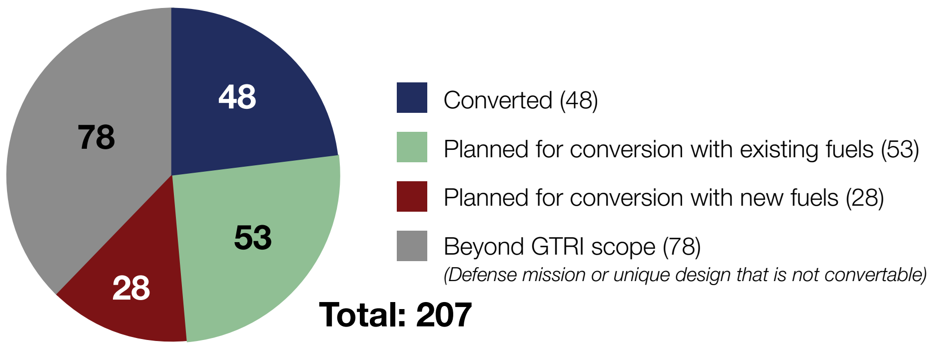
High-Density Fuel

- **HEU**: up to 100 kg of tubular uranium aluminide or oxide dispersion fuel
- **LEU**: requires high-density fuel under development: U-Mo

LIFECYCLE PLAN



RESULTS: REACTORS CONVERTED AS OF DECEMBER 2006



Molybdenum 99 Production

- Molybdenum 99 (Mo-99) is the most commonly used medical isotope in the world - an estimated 20-25 million procedures annually use Mo-99
- Approximately 90% of the world's supply of Mo-99 is produced by irradiating HEU targets

Small Mo-99 Producers Already Use LEU

- Argentina and Australia have small-scale commercial production of Mo-99 using LEU
- With support provided by GTRI, the IAEA has initiated a multilateral Coordinated Research Project to assist in the production of Mo-99 using LEU

Major Mo-99 Producers Still Use HEU

- A Canadian firm, MDS Nordion produces about 40% of the world's supply of Mo-99
- Other major suppliers include Dutch firm Tyco (30% share), South African firm NTP (10%), and Belgian firm Tyco/IRE (9% share)

U.S. Mo-99 Production

- The University of Missouri research reactor has a joint project with the Argonne National Laboratory to produce Mo-99 using LEU targets
- BWXT is developing an alternative production model with lower costs and less waste

DID YOU KNOW?

Prior to the creation of GTRI, 39 research reactors were converted over 26 years, a rate of 1.5 per year. Since GTRI was established, the program has accelerated the conversion rate, with 5 conversions in FY 2006 alone.

CONVERT STEPS

Initiate and Scope
- Letter of intent and agreement
- Roles and responsibilities
- Schedule

Studies
- Conversion feasibility study
- Safety analysis report

Regulatory Approval

LEU Replacement Fuel
- Manufacturing contract
- Delivery

Convert Reactor
- Conversion preparations
- Load LEU
- Test start with LEU

DID YOU KNOW?

In October 2005, for the first time ever, a Russian-supplied research reactor was converted to LEU when the GTRI program converted the VR-1 Sparrow reactor at the Czech Technical University in Prague.

In September 2006, the research reactors at Texas A&M University and the University of Florida were converted by GTRI from HEU to LEU, representing the first U.S. domestic reactors converted in more than six years. In addition, these conversions were the first to take place under the Security and Prosperity Partnership between the United States, Canada, and Mexico, which calls for civilian HEU research reactors in these countries to be converted by 2011.

REMOVE PROGRAMS

Foreign Research Reactor Spent Nuclear Fuel Acceptance (FRRSNF)
Established: 1996

U.S. Radiological Threat Reduction (USRTR)
Established: 1997

Russian Research Reactor Fuel Return (RRRFR)
Established: 2002

Gap Materials
Established: 2005

OBJECTIVE

GTRI's Remove Program supports permanent threat reduction by eliminating stockpiles of excess weapons-usable nuclear and radiological materials located at civilian sites throughout the world. The Remove Program is key to the mission because it eliminates the dangerous nuclear and radiological materials from civilian sites. Once the material is removed there is one less source for the terrorists.

SCOPE OF WORK

By 2013, remove or dispose of 4,384 kg of nuclear material (HEU and plutonium) from civilian sites (enough for 180 crude nuclear weapons). There are additional nuclear materials located at civilian sites that are not targeted for removal because they have an acceptable disposition path or they are in secure locations. GTRI will continue to remove U.S.-origin spent LEU fuel from foreign research reactors until 2019 as an incentive for converting research reactors from HEU to LEU fuels.

By 2020, remove 31,700 excess U.S. radiological sources totaling about 450,000 curies (enough for 2,255 radiological dirty bombs). Each year about 2,000 radioactive sources containing approximately 30,000 total curies are registered unused or excess in the United States.

DID YOU KNOW?

The U.S.-Origin Nuclear Removal efforts include the return of LEU Spent Nuclear Fuel (SNF) as an incentive for reactor conversion to LEU. This program will accept all eligible spent HEU and LEU until 2019. As of December 2006, 11 countries have returned all of their U.S.-origin HEU (Brazil, Chile, Colombia, Greece, Italy, Philippines, Slovenia, Spain, Sweden, Switzerland, and Thailand).

U.S.-Origin Nuclear Removal

Accepts only MTR, TRIGA and target material fresh and spent HEU and LEU from foreign research reactors who agree to convert to LEU. Material is shipped to the United States for secure disposition

Funds transportation activities from countries designated as other-than-high-income (OTHI) economies by the World Bank

Signs contracts directly between DOE/NNSA and research reactors

Will accept spent fuel until **2019**

U.S.-Origin Fuel Removal from Japan

Russian-Origin Nuclear Removal

Repatriates Russian-origin HEU fresh and spent fuel from research reactors worldwide to Russia for secure down blending and disposition

Provides replacement LEU fuel in return for HEU fresh fuel removal

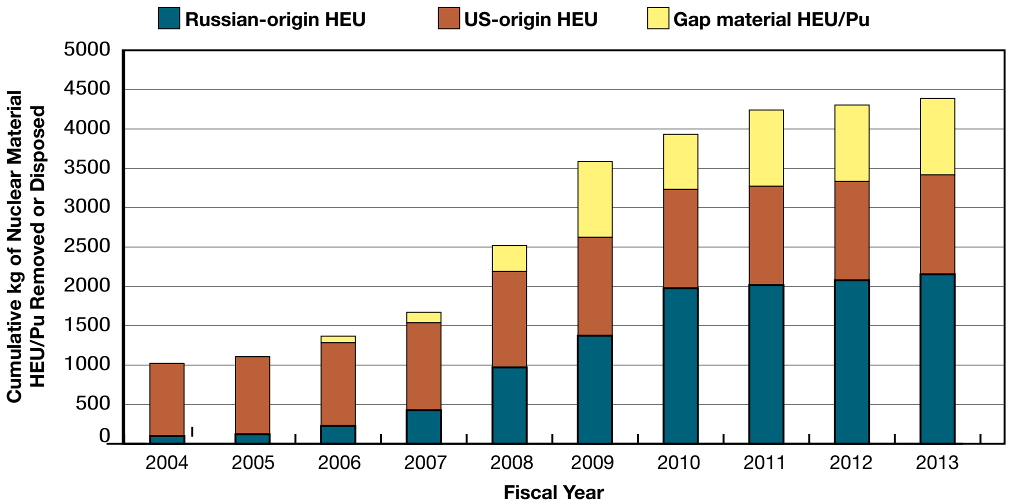
Conducts fresh fuel removal under the auspices of the IAEA

Conducts spent fuel removal through contracts between DOE/NNSA and research reactor facilities

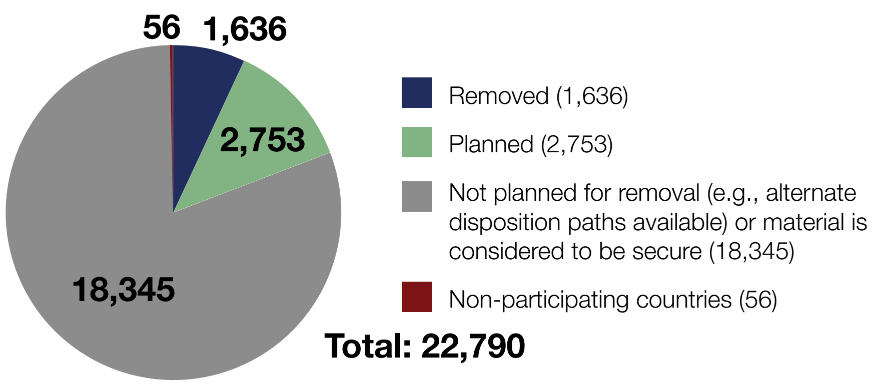
Funds fresh and spent fuel removal for OTHI countries

HEU Spent Fuel Removal from Uzbekistan

LIFECYCLE PLAN



RESULTS: HEU AND PLUTONIUM REMOVED (KG) AS OF DECEMBER 2006



REMOVE STEPS

Initiate and Scope
- Fact finding
- Letter of intent/agreement
- Identify incentives
- Schedule
- Sign contractors

Regulatory Approval
- Safety evaluation
- Transportation certificate
- Export/Import licenses
- Package license
- Ecological reviews

Prepare for Shipment
- Characterize material
- Facility preparations

Shipment
- Package material
- IAEA safeguards notification
- Move material

Material Disposition
- Receive material
- Interim storage
- Final disposition
- Return waste

GAP Nuclear Removal

Facilitates the disposition of high risk, vulnerable nuclear material not covered by other removal efforts, including:

- U.S.-origin HEU material not covered by the U.S.-origin Nuclear Removal effort
- HEU of non-U.S.- and non-Russian-origin
- Separated plutonium

Identifies excess nuclear material that could pose a potential terrorist concern by working with facility operators and others

Explores commercial disposition options

Explores safe disposition in the United States

Fresh HEU Removal from Belgium

Emerging Threats Program

Develops and maintains a capability to rapidly de-nuclearize comprehensive nuclear development programs while supporting verification efforts

Provides for in-country stabilization, packaging and removal of nuclear materials

Allows for independent, self-sufficient operation

Establishes Rapid Response Teams to ensure that when opportunities present themselves, GTRI is able to respond quickly and efficiently

Glovebox inside mobile plutonium processing facility

DID YOU KNOW?

Due to its high level of radioactivity, HEU spent fuel removal is more complicated than HEU fresh fuel removal and requires additional steps:

- **Potential facility modifications to accommodate spent fuel transport casks**
- **Government-to-government agreements to provide nuclear liability protection**
- **Environmental impact review**
- **Shipment by rail and sea instead of air**

BRATISLAVA

"the United States and Russia will continue to work … to return fresh and spent high enriched uranium from U.S.- and Russian-designed research reactors in third countries."

Joint Statement on Nuclear Security Cooperation
Bratislava
February 2005

DID YOU KNOW?

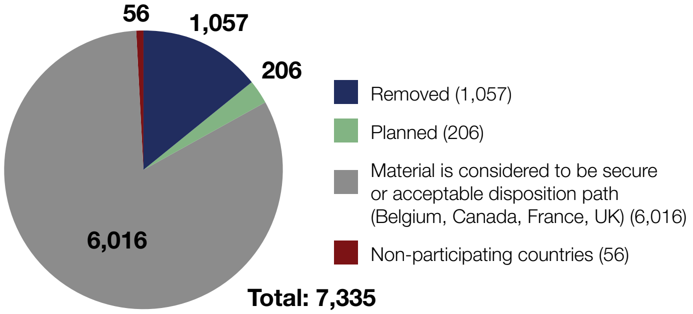
The Bratislava Agreement has greatly accelerated the return of Russian-origin HEU. Prior to the Agreement in February 2005, 105 kg in six shipments over nearly three years were completed. Since the Agreement, and through December 2006, an additional 391 kg in 10 shipments in less than two years were completed.

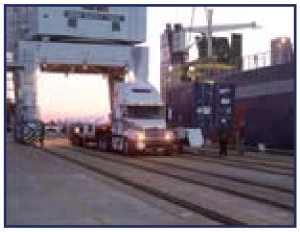
DID YOU KNOW?

The first-ever repatriation of Russian-origin HEU spent fuel was achieved by the GTRI program in January 2006 when the first of four shipments to remove 63 kg from the Institute of Nuclear Physics in Uzbekistan took place.

THREE PROGRAMS COMPRISE NUCLEAR REMOVE EFFORTS:

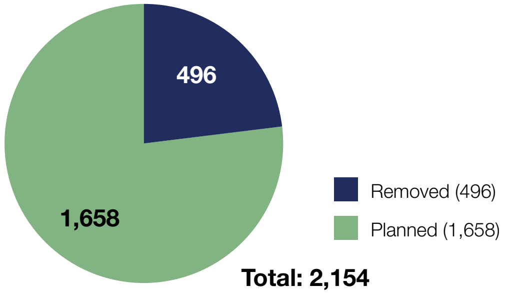
U.S.-ORIGIN HEU (KG) AS OF DECEMBER 2006





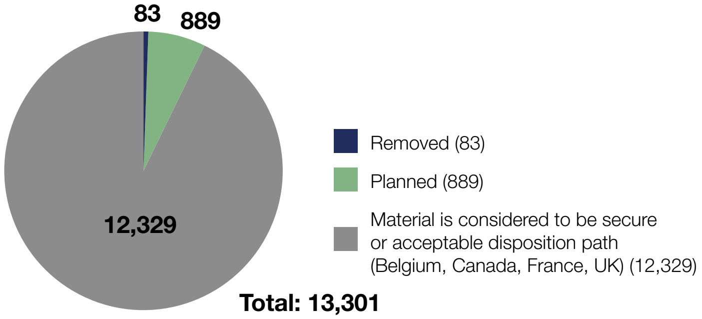
Unloading U.S.-origin Spent HEU removed from Germany

RUSSIAN-ORIGIN HEU (KG) AS OF DECEMBER 2006



Russian-origin Fresh Fuel Removal from Latvia

GAP NUCLEAR MATERIALS (KG) AS OF DECEMBER 2006

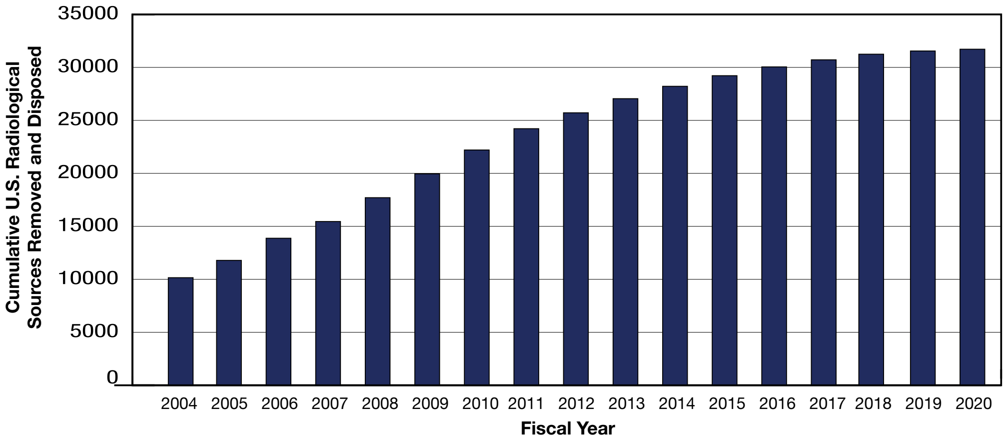


Gap Fresh HEU Removal

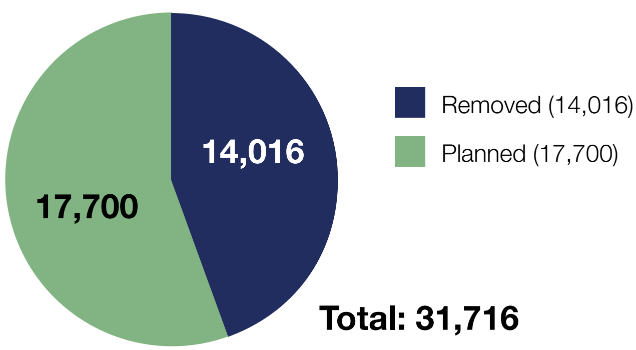
DID YOU KNOW?

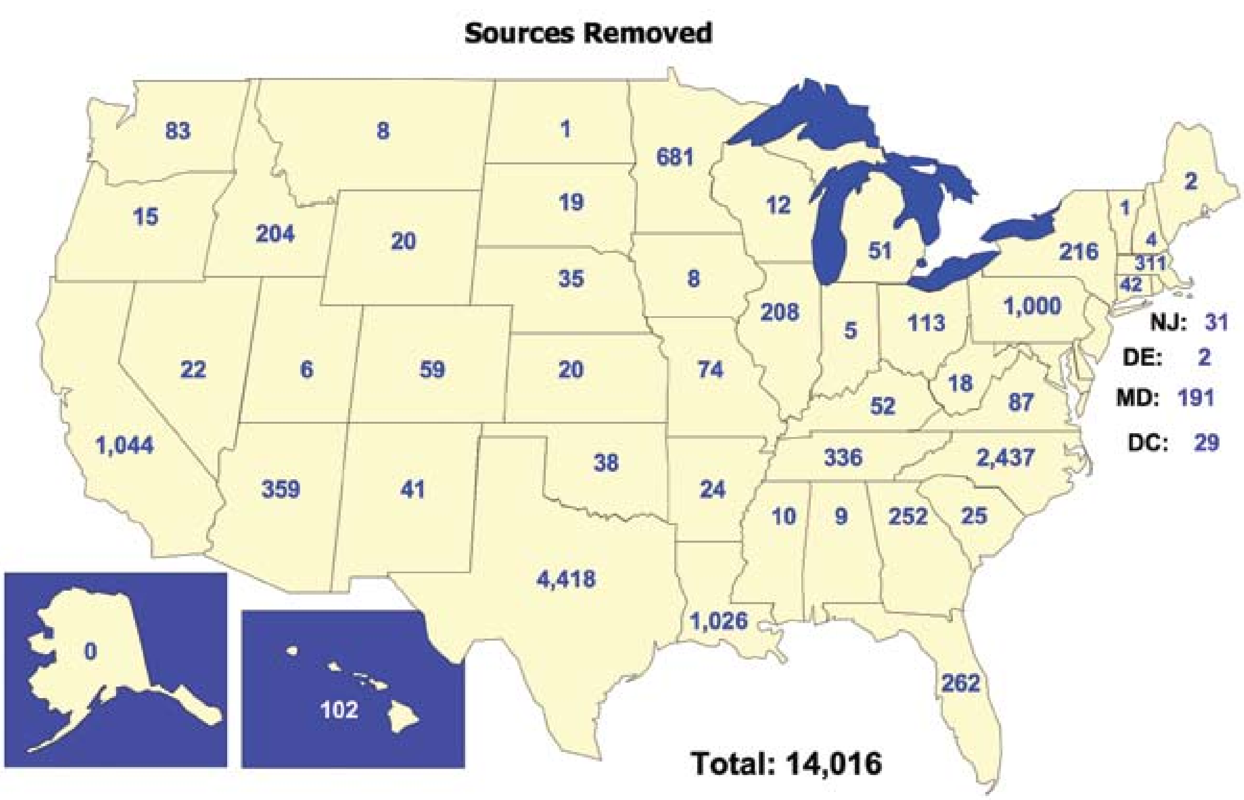
The December 2006 GTRI shipment to remove more than 265 kg of Russian-origin fresh HEU from a former East Germany civilian nuclear facility was the largest shipment of HEU ever under NNSA's GTRI program. The shipment of HEU from the Rossendorf nuclear facility is more material than the combined total amount that had previously been removed under the entire Russian fuel return program. This shipment was part of the prioritized accelerated schedule in support of the Bratislava Joint Statement on Nuclear Security Cooperation.

LIFECYCLE PLAN



RESULTS: U.S. RADIOLOGICAL SOURCES REMOVED AS OF DECEMBER 2006





DID YOU KNOW?

The small size and portability of medical radiological sources make them attractive to terrorists. As little as 1,000 curies of Cesium-137 or Cobalt-60, which are used in cancer treatment teletheraphy units, can pose a significant risk if used for a radiological dirty bomb. Many medical facilities lack the rigorous security of military sites given their need to be accessible to the general public. For comparison, a 1987 accident in Brazil involving a 1,378 curie medical source of Cesium Chloride killed four people, caused widespread panic, and resulted in $36 million in decontamination costs. These sources are a high priority for the GTRI program.

PROTECT PROGRAMS

Kazakhstan Spent Fuel
Established: 1996

Global Research Reactor Security (GRRS)
Established: 1997

International Radiological Threat Reduction (IRTR)
Established: 2003

DID YOU KNOW?

In 2004, GTRI installed security upgrades at 18 radiological sites in Greece in advance of the Olympic Games. GTRI also donated 110 hand-held radiological detection devices to the Greek Atomic Energy Commission and to law enforcement officials.

In 2004, GTRI collaborated with the Department of Defense on Operation Maximus, which removed about 1,000 highly radio-active sources from Iraq.

In 2005, GTRI cooperated with the Russian Federation to remove more than 5,000 curies of Cobalt-60 and Cesium-137, enough material for at least five radiological dirty bombs, from a highly vulnerable site in war-torn Chechnya and safely returned these sources to Moscow for protection and disposition.

OBJECTIVE

GTRI's Protect Program supports threat reduction by securing stockpiles of weapons-usable nuclear and radiological materials located at civilian sites throughout the world. The Protect Program is key to the mission because it rapidly upgrades the physical security at vulnerable nuclear and radiological material sites by improving threat detection, delay, and response capabilities until a permanent threat reduction solution can be implemented.

SCOPE OF WORK

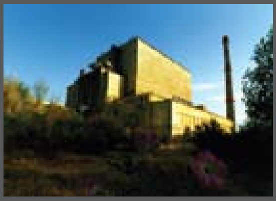
By 2010, complete physical protection upgrades at 22 research reactor facilities outside of the former Soviet Union. This will ensure that all vulnerable nuclear materials are protected from theft or diversion until permanent disposition of the material can be implemented.

By 2010, complete safe and secure long-term storage of 3,000 kilograms of plutonium and 10,000 kilograms of HEU (enough for 775 crude nuclear weapons) from the BN-350 reactor in Kazakhstan.

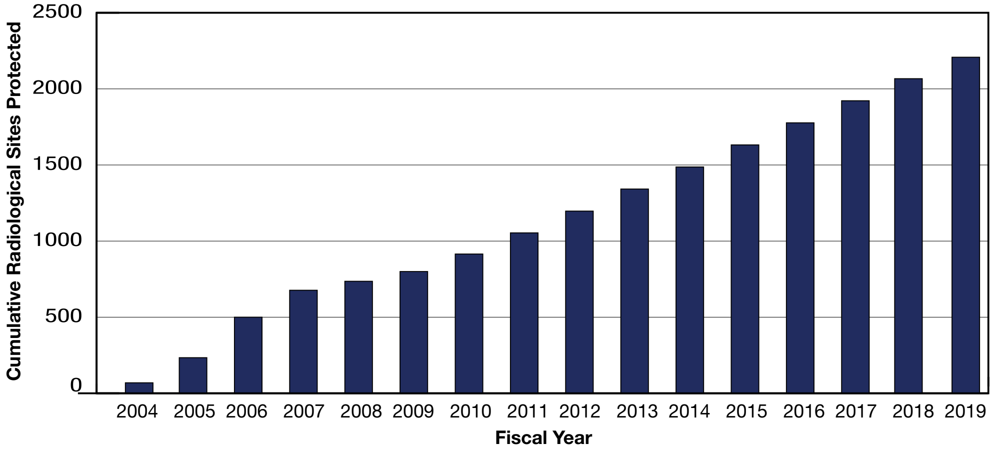
By 2028, protect 3,300 high-priority radiological sites totaling about 50,000,000 curies (enough for 50,000 radiological dirty bombs). The IAEA estimates that there are millions of radiological sources located at tens of thousands of civilian sites worldwide. These radioactive sources are used for medical, industrial, and other commercial purposes and range from a fraction of a curie up to 10,000,000 curies each. The GTRI program has focused on protecting about 3,300 vulnerable sites located in other-than-high-income economy countries that store sources of 1,000 curies or greater and that are near U.S. strategic interests overseas.

PROTECTING NUCLEAR MATERIALS IN KAZAKHSTAN

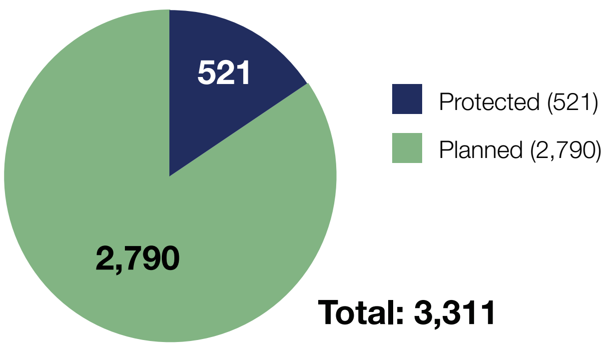
The BN-350 fast breeder reactor located at Aktau, Kazakhstan on the Caspian Sea is a Russian-designed dual-use reactor that was built to provide power and heat while breeding weapons-grade plutonium. In 1996, DOE first visited the BN-350 site and discovered 300 metric tons of spent fuel stored in the cooling pool. This spent fuel contains three metric tons of plutonium and 10 metric tons of HEU—enough material to fabricate 775 crude nuclear weapons. The objective of the Kazakhstan Spent Fuel program is to provide long-term (up to 50 years) safe and secure storage of this material.



LIFECYCLE PLAN



RESULTS: RADIOLOGICAL SITES PROTECTED AS OF DECEMBER 2006



PROTECT STEPS

Initiate and Scope
- Letter of intent/agreement
- Site assessment
- Vulnerability assessment
- Protection concept

System Design
- Identify contractor
- Conceptual design
- Final design

Rapid upgrades
- Installation
- Assurance visit

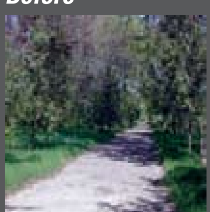
Comprehensive Upgrades
- Installation
- Training
- Acceptance testing

Sustain
- 3-year warranty
- Regulations, procedures, training
- Annual assurance visit

WHAT IS PHYSICAL PROTECTION?

Securing vulnerable materials by improving facilities' ability to detect, delay, and respond to attempts to access materials.

Before

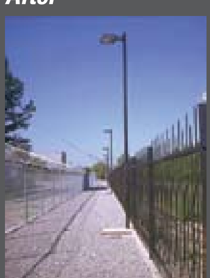


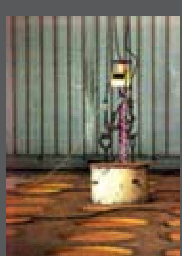
Detect the Threat:
- Install exterior and interior sensors
- Enhance alarm communication and assessment
- Ensure entry control

Delay the Threat:
- Protective force guards
- Install or enhance barriers to material access

Respond to the Threat:
- Train and equip response force for threat interruption and neutralization
- Ensure effective communications among protective force guards

After





DID YOU KNOW?

GTRI accelerated efforts with the Russian Federation to secure and consolidate Radioisotopic Thermoelectric Generators (RTGs), each containing about 30,000 curies of strontium-90. This activity has recently been added to the Report to the Presidents on implementation of the Bratislava Joint Statement on Nuclear Security Cooperation.

Removing RTGs along the Russian Coast


GREENLAND
HUNGARY
DENMARK
NETHERLANDS
CZECH REPUBLIC
BELGIUM
GERMANY
POLAND
ICELAND
CANADA
6
2
IRELAND
SWITZERLAND 2
AUSTRIA 2
BOSNIA
CROATIA
SLOVENIA 1
GREECE 1
ITALY 1
SERBIA/MONTENEGRO
ALBANIA
MACEDONIA
MOLDOVA
ROMANIA 1
BULGARIA 1
FRANCE
SPAIN
PORTUGAL
1
28
UNITED STATES OF AMERICA
MOROCCO
WESTERN SAHARA
MAURITANIA
SENEGAL
GAMBIA
GUINEA-BISSAU
GUINEA
SIERRA LEONE
LIBERIA
IVORY COAST
GHANA 1
REP. OF THE CONGO
1
MEXICO
BAHAMAS
CUBA
DOMINICAN REPUBLIC
HAITI
JAMAICA
PUERTO RICO
BELIZE
HONDURAS
GUATEMALA
EL SALVADOR
NICARAGUA
COSTA RICA
PANAMA
TRINIDAD & TOBAGO
GUYANA
SURINAM
FRENCH GUIANA
VENEZUELA
1
COLOMBIA
ECUADOR
GUATEMALA
EL SALVADOR
HONDURAS
NICARAGUA
COSTA RICA
PANAMA
JAMAICA 1
HAITI
1
BRAZIL
PERU
BOLIVIA
PARAGUAY
2 CHILE
URUGUAY
ARGENTINA 2
FALKLAND/MALVINAS ISLANDS
U.S. DEPARTMENT OF ENERGY
GTRI
NATIONAL NUCLEAR SECURITY ADMINISTRATION
DEFENSE NUCLEAR NONPROLIFERATION


ESTONIA
LATVIA
LITHUANIA
BELARUS
SWEDEN
FINLAND
NORWAY
DENMARK
NETH
GERMANY
POLAND
LUX
CZECH
SLOVAKIA
UKRAINE
SWITZ
AUSTRIA
HUNGARY
MOLDOVA
SLOVENIA
CROATIA
ROMANIA
BOSNIA-HERZEGOVINA
SERBIA
MONT
BULGARIA
ANDORRA
ITALY
ALBANIA
MACEDONIA
GREECE
TURKEY
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AZERBAIJAN
TURKMENISTAN
UZBEKISTAN
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NEPAL
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TUNISIA
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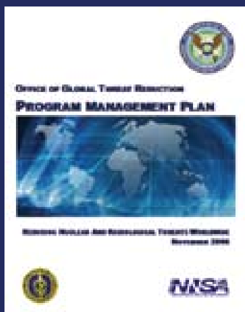
QATAR
UNITED ARAB EMIRATES
OMAN
YEMEN
INDIA
BANGLADESH
BURMA
LAOS
HONG KONG
TAIWAN
THAILAND
VIETNAM
CAMBODIA
NIGER
CHAD
SUDAN
ERITREA
NIGERIA
CENTRAL AFRICAN REPUBLIC
ETHIOPIA
CAMEROON
EQUATORIAL GUINEA
GABON
Rep. of Congo
DEMOCRATIC REPUBLIC OF THE CONGO
UGANDA
KENYA
SOMALIA
RWANDA
BURUNDI
TANZANIA
ANGOLA
ZAMBIA
MALAWI
MOZAMBIQUE
MADAGASCAR
MAURITIUS
RÉUNION
NAMIBIA
ZIMBABWE
BOTSWANA
SWAZILAND
LESOTHO
SOUTH AFRICA
SRI LANKA
PHILIPPINES
MALAYSIA
BRUNEI
INDONESIA
PAPUA NEW GUINEA
SOLOMON ISLANDS
VANUATU
FIJI
NEW CALEDONIA
AUSTRALIA
NEW ZEALAND
KEY
CONVERT HEU FUELED RESEARCH REACTORS
REMOVE/PROTECT NUCLEAR MATERIALS
REMOVE/PROTECT RADIOLOGICAL MATERIALS
GTRI COOPERATION WITH MORE THAN 90 COUNTRIES

COST AND SCHEDULE MANAGEMENT SYSTEM



Program Management Plan
- Roles and responsibilities
- Budget structure
- Work breakdown structure (WBS)

Project Work Plans (PWPs)
- Scope
- Material inventory
- Priorities
- Performance baseline (resource loaded schedule to ensure budget and performance integration)

Execution and Evaluation
- Integrated change control
- Delegated authority and accountability
- Monthly performance monitoring using earned value
- Performance reviews (Joule, PART, and program/project reviews)

Risk Management
- Risk identification and control
- Contingency management

MANAGING THREAT REDUCTION WORK

GTRI uses an integrated management approach focused on achieving results in a cost-effective manner. GTRI strives to create a well-managed, responsive, and accountable organization consistent with the President's Management Agenda; the Department of Energy, National Nuclear Security Administration, and the Office of Defense Nuclear Nonproliferation Strategic Plans; and sound business practices.

Key elements of GTRI's integrated management approach include:

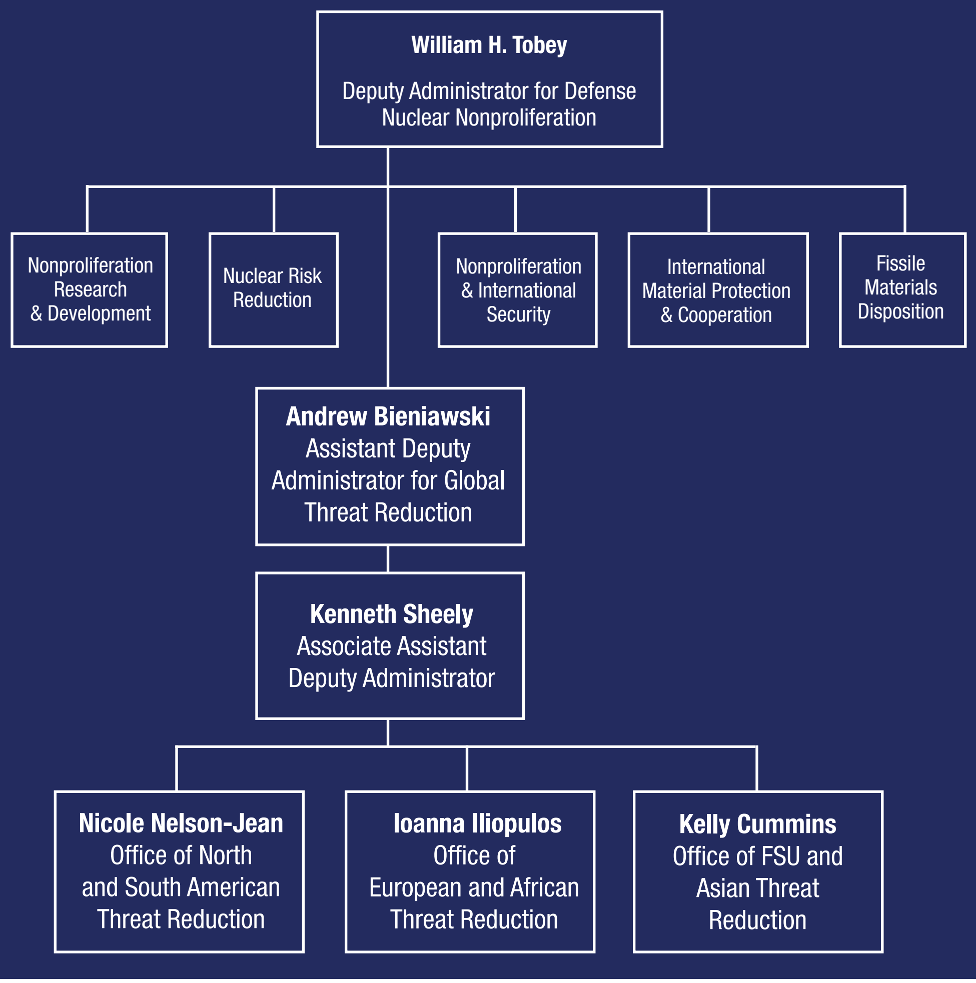
- Clear, meaningful, measurable, and integrated mission, goals, priorities, and performance measures to best articulate program plans and results;
- A single comprehensive database to understand and communicate the program's total scope and progress;
- An integrated threat reduction criteria document to ensure that resources are focused on the most attractive and most vulnerable material first, and that threat reduction efforts are consistent in achieving the most effective permanent solutions;
- Regional roadmaps that include consolidation strategies, regional partners, and country-specific incentives to accelerate threat reduction;
- An integrated cost and schedule management system that uses best-in-class business practices to improve performance and Project Work Plans (PWPs) that include detailed scope, cost, and schedule baselines;
- A program-wide procurement strategy that optimizes cost effectiveness by using the best features of public, private, and combined capabilities;
- An organizational structure that facilitates the implementation of the program goals, empowers people to achieve results, enforces accountability for performance, and develops a cadre of talented people;
- Enhanced, cost-effective use of information technology; and
- Strengthened customer service by ensuring products and services are delivered on time, within cost, and in accordance with our commitments.

Beginning in October 2006, GTRI has legislative authority to enter into agreements to accept contributions for international threat reduction work. It is anticipated that foreign governments or other international partners would provide funds to GTRI to accelerate permanent threat reduction efforts.

DID YOU KNOW?

GTRI received the Office of Management and Budget's (OMB) highest rating of "Effective" during the OMB's independent Program Assessment Rating Tool (PART) review of the program in 2006.

ORGANIZATIONAL STRUCTURE



THREAT REDUCTION CRITERIA:

1. Determine nuclear and radioactive material attractiveness for use in a WMD.
2. Define external terrorist threat environment within each country.
3. Assess unique internal vulnerability conditions at each site.
4. Determine proximity of potential threats to U.S. strategic interests.
5. Based on integrated score, implement appropriate prioritized convert, remove, or protect actions.

PERFORMANCE MEASURES

Convert	By 2018, convert to LEU 129 of 207 HEU reactors.
Remove Nuclear and Radiological Materials	By 2013, remove or dispose of 4,384 kg of nuclear material (HEU and plutonium) from civilian sites (enough for 180 crude nuclear weapons). By 2020, remove 31,700 excess U.S. radiological sources totaling about 450,000 curies (enough for 2,255 radiological dirty bombs).
Protect Nuclear and Radiological Materials	By 2010, complete physical protection upgrades at 22 research reactor facilities outside of the former Soviet Union. By 2010, complete safe and secure long-term storage of 3,000 kg of plutonium and 10,000 kg of HEU (enough for 775 crude nucelar weapons) from the BN-350 reactor in Kazakhstan. By 2028, protect 3,300 high-priority radiological sites totaling about 50,000,000 curies (enough for 50,000 radiological dirty bombs).

National Nuclear Security Administration

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